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MAINTENANCE

PNEUMATIC & ELECTRO-PNEUMATIC CONTINUOUS FLOW CONTROL SYSTEM

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P/N 22504-09
P/N 22504-11
P/N 22505-07
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*Table of Contents	Apr 15/84
*i	Apr 15/84
*ii (Blank)	Apr 15/84
1	Apr 15/84
*2	Apr 15/84
*3	Apr 15/84
*4	Apr 15/84
*5	Apr 15/84
*6	Apr 15/84
*7	Apr 15/84
*8	Apr 15/84
*9	Apr 15/84
*10	Apr 15/84

*The asterisk indicates pages revised or added by the current revision.

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TEMPORARY REV. NO.	PAGE NUMBER	ISSUE DATE	BY	DATE REMOVED	BY

SCOTT

22504-7,-9,-11 & 22505-7,-9
MAINTENANCE MANUAL

TABLE OF CONTENTS

IMPORTANT WARNINGS

WARNING: ANY SERVICE OR OVERHAUL PERFORMED ON THIS APPARATUS SHALL BE DONE ONLY BY THOSE FACILITIES EXPERIENCED IN, OR BY PERSONNEL KNOWLEDGEABLE IN HIGH PRESSURE AVIATION OXYGEN EQUIPMENT. IF NONE ARE KNOWN, CONTACT SCOTT AVIATION OR ITS DISTRIBUTORS FOR NAMES OF AUTHORIZED SERVICE CENTERS.

WARNING: ALL PROCEDURES DESCRIBED IN THIS MANUAL SHALL BE PERFORMED IN AN AREA FREE OF OIL, GREASE, FLAMMABLE SOLVENTS OR OTHER COMBUSTIBLE MATERIALS. SUCH MATERIALS, AS WELL AS DUST, LINT, AND FINE METAL FILINGS ARE ALL POTENTIAL COMBUSTIBLES WHICH MIGHT, WHEN EXPOSED TO OXYGEN UNDER PRESSURE IGNITE AND RESULT IN AN EXPLOSION AND/OR FIRE.

WARNING: DO NOT ALLOW OIL, GREASE, FLAMMABLE SOLVENTS, OR OTHER COMBUSTIBLE MATERIALS TO COME IN CONTACT WITH PARTS THAT WILL BE EXPOSED TO PRESSURIZED OXYGEN. SUCH MATERIALS, AS WELL AS DUST, LINT, AND FINE METAL FILINGS ARE ALL POTENTIAL COMBUSTIBLES WHICH MIGHT, WHEN EXPOSED TO OXYGEN UNDER PRESSURE, IGNITE AND RESULT IN AN EXPLOSION.

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PNEUMATIC & ELECTRO-PNEUMATIC CONTINUOUS FLOW CONTROL SYSTEM

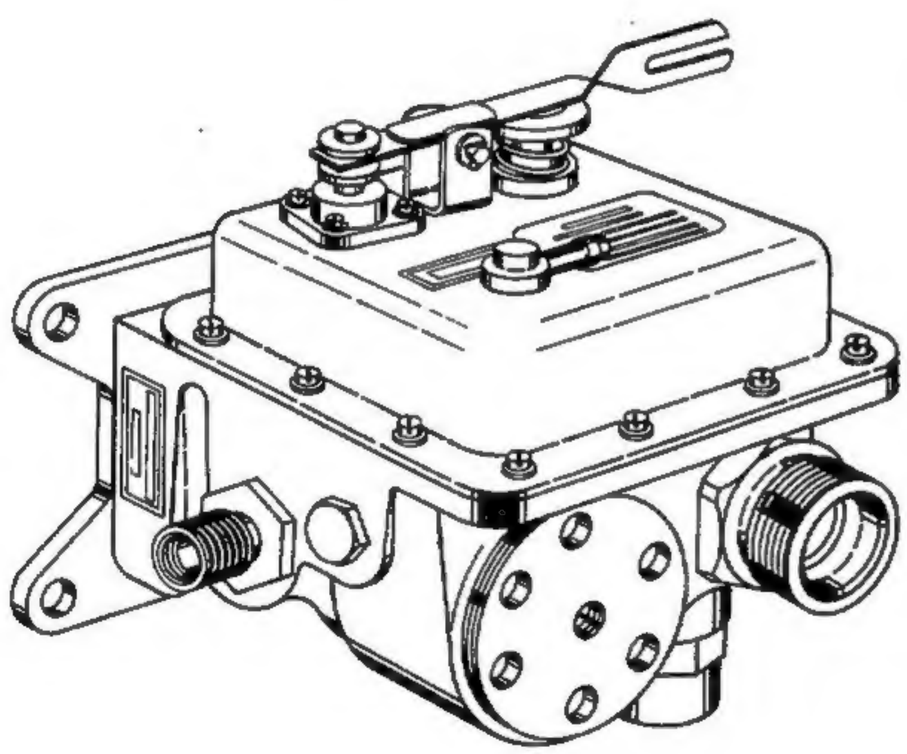
1. General

A. This manual provides maintenance instructions for the Penumatic & Electro-Pneumatic Continuous Flow Control System. The system consists of a Pneumatic Continuous Flow Control Unit, part number 22505-7 and 22505-9 (see figure 1), and an Electro-Pneumatic Continuous Flow Control Unit, part numbers 22504-7, 22504-9 or 22504-11 (see figure 2).

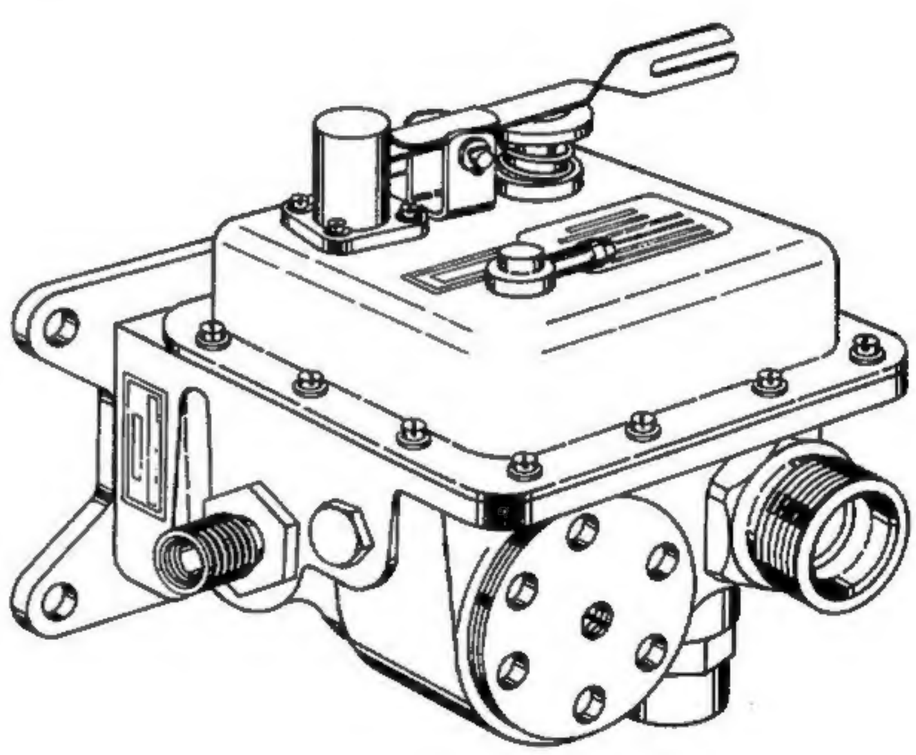
2. Servicing

WARNING: DO NOT ALLOW OIL, GREASE, FLAMMABLE SOLVENTS, OR OTHER COMBUSTIBLE MATERIALS TO COME IN CONTACT WITH PARTS THAT WILL BE EXPOSED TO PRESSURIZED OXYGEN. SUCH MATERIALS, AS WELL AS DUST, LINT, AND FINE METAL FILINGS ARE ALL POTENTIAL COMBUSTIBLES WHICH MIGHT, WHEN EXPOSED TO OXYGEN UNDER PRESSURE, IGNITE AND RESULT IN AN EXPLOSION.

A. No servicing is required.



Pneumatic Continuous Flow
Control Unit
Figure 1



Electro-Pneumatic Continuous
Flow Control Unit
Figure 2

3. Description and Operation

A. Purpose of Equipment

(1) The Pneumatic & Electro-Pneumatic Continuous Flow Control System forms part of the aircraft emergency oxygen system when installed in a pressurized cabin. When the cabin pressure drops below a pressure equivalent to 13,250 to 14,500 feet altitude for part numbers 22504-7, 22504-9 and 22505-7 and 14,000 to 15,000 feet altitude for part numbers 22504-11 and 22505-9, the system automatically initiates and controls the flow of oxygen from a high pressure gaseous source to the passenger mask compartments. The system may also be activated at any altitude manually, at the Pneumatic Continuous Flow Control Unit, and/or electrically through the Electro-Pneumatic Continuous Flow Control Unit.

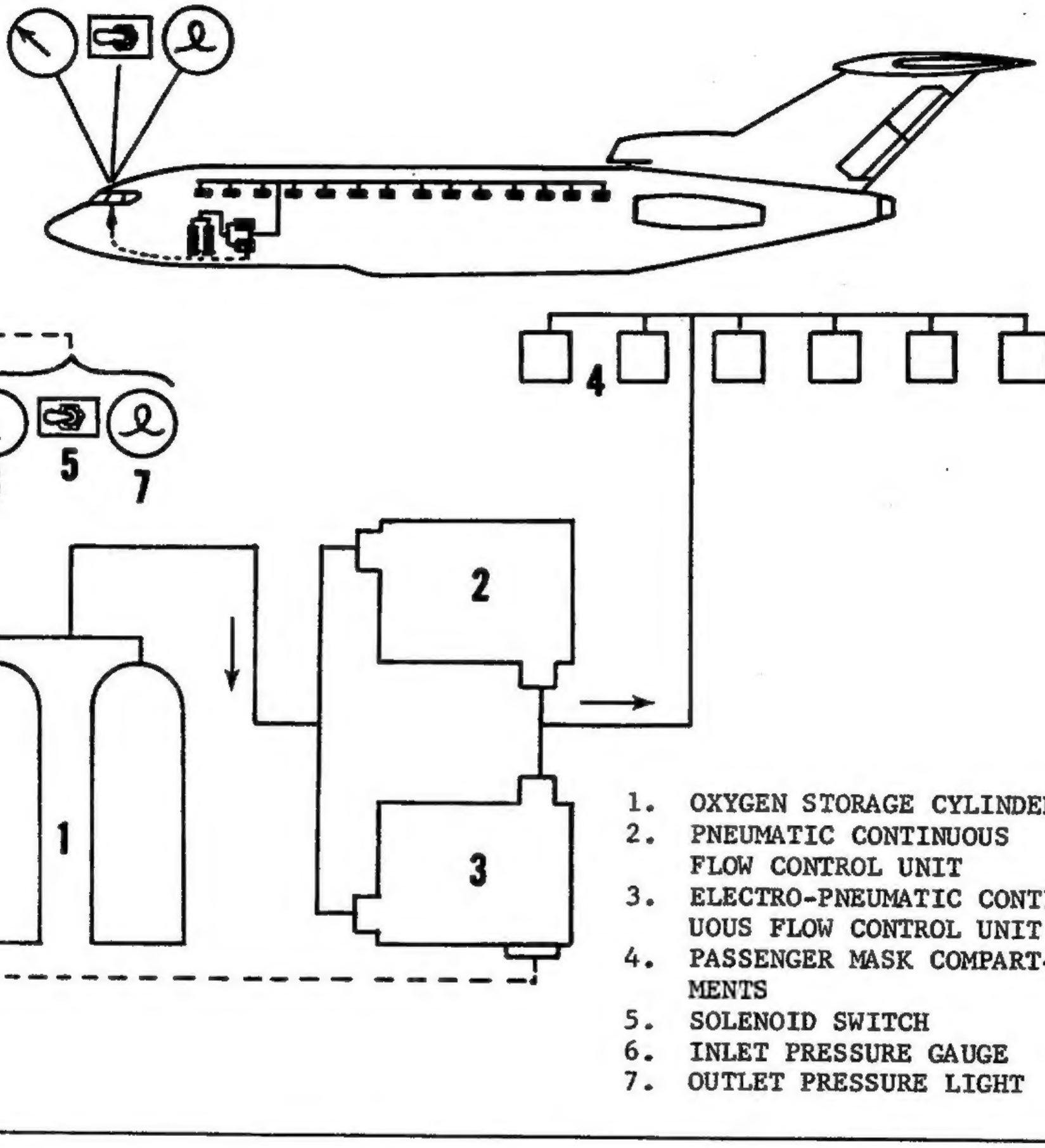
B. Typical Installation

(1) A typical pressurized cabin installation of the Pneumatic Continuous Flow Control System is shown in Figure 3. An oxygen source consisting of a series of high pressure oxygen storage cylinders (1) is connected to the inlet of Pneumatic Continuous Flow Control Unit (2) and Electro-Pneumatic Continuous Flow Control Unit (3) to the passenger mask compartments (4).

(2) Control units (2 and 3) are normally closed. In the event of cabin decompression, the aneroids within control units (2 and 3) are preset to automatically open and control the flow of oxygen to passenger mask compartments (4). If required, the system may be activated manually at control unit (2) and/or electrically by a crew member from the cockpit of the aircraft through control unit (3), to supply oxygen to passenger mask compartment (4). (Switch (5) controls electrical actuation of control unit (3).)

(3) Inlet pressure is monitored continuously on gauge (6) in the cockpit of the aircraft through a pressure transducer in control unit (3). When the system is activated either automatically, manually, or electrically, light (7) in the cockpit of the aircraft and in the passenger compartment is illuminated indicating presence of outlet pressure. This outlet pressure is sensed by a pressure switch in control unit (3).

NOTE: The 22504-9 control unit (3) does not contain a pressure transducer.



1. OXYGEN STORAGE CYLINDERS
2. PNEUMATIC CONTINUOUS FLOW CONTROL UNIT
3. ELECTRO-PNEUMATIC CONTINUOUS FLOW CONTROL UNIT
4. PASSENGER MASK COMPARTMENTS
5. SOLENOID SWITCH
6. INLET PRESSURE GAUGE
7. OUTLET PRESSURE LIGHT

Typical Installation
Figure 3

C. Operation (See figure 4)

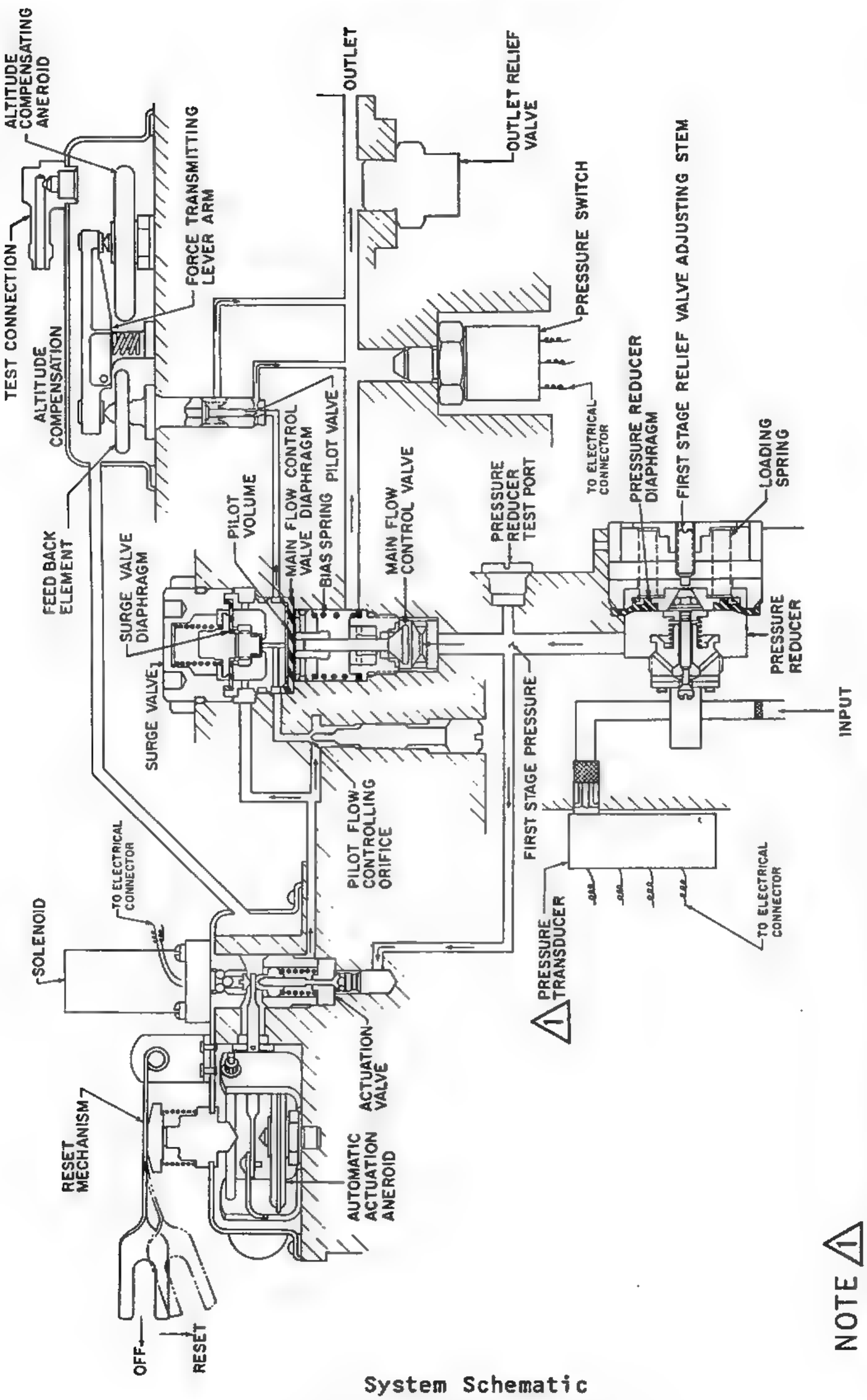
(1) Pressure Reducer. When oxygen at pressures ranging from full cylinder pressure (1850 psi) down to 300 psi is introduced at the inlets of the system, the single stage pressure reducer reduces the pressure to a relatively constant value of approximately 100 psig. This controlled first stage pressure is routed to the pilot-operated main flow control valve and to the actuation valve.

(2) Automatic Actuation. At an altitude of 13,250 to 14,500 feet, for part numbers 22504-7,-9 and 22505-7 and 14,000 to 15,000 feet for part numbers 22504-11 and 22505-9, the aneroid in the automatic actuation mechanism develops sufficient force to overcome the tension of the leaf spring. The force trips the leaf spring past center and moves the lever against the actuation valve, which then opens and allows the first stage pressure to be applied to the pilot flow controlling orifice and to the surge valve.

(3) Manual Actuation. The system may be activated manually at any altitude by raising the manual actuation mechanism on the pneumatic control unit. Raising the manual actuation mechanism applies pressure to the actuation valve thereby overriding the automatic mechanism.

(4) Electrical Actuation. The system may be actuated electrically at any altitude by momentarily energizing the solenoid switch in the cockpit of the aircraft. Actuation of the solenoid within the electro-pneumatic control unit overrides a detent causing opening of the actuation valve and overriding the automatic mechanism.

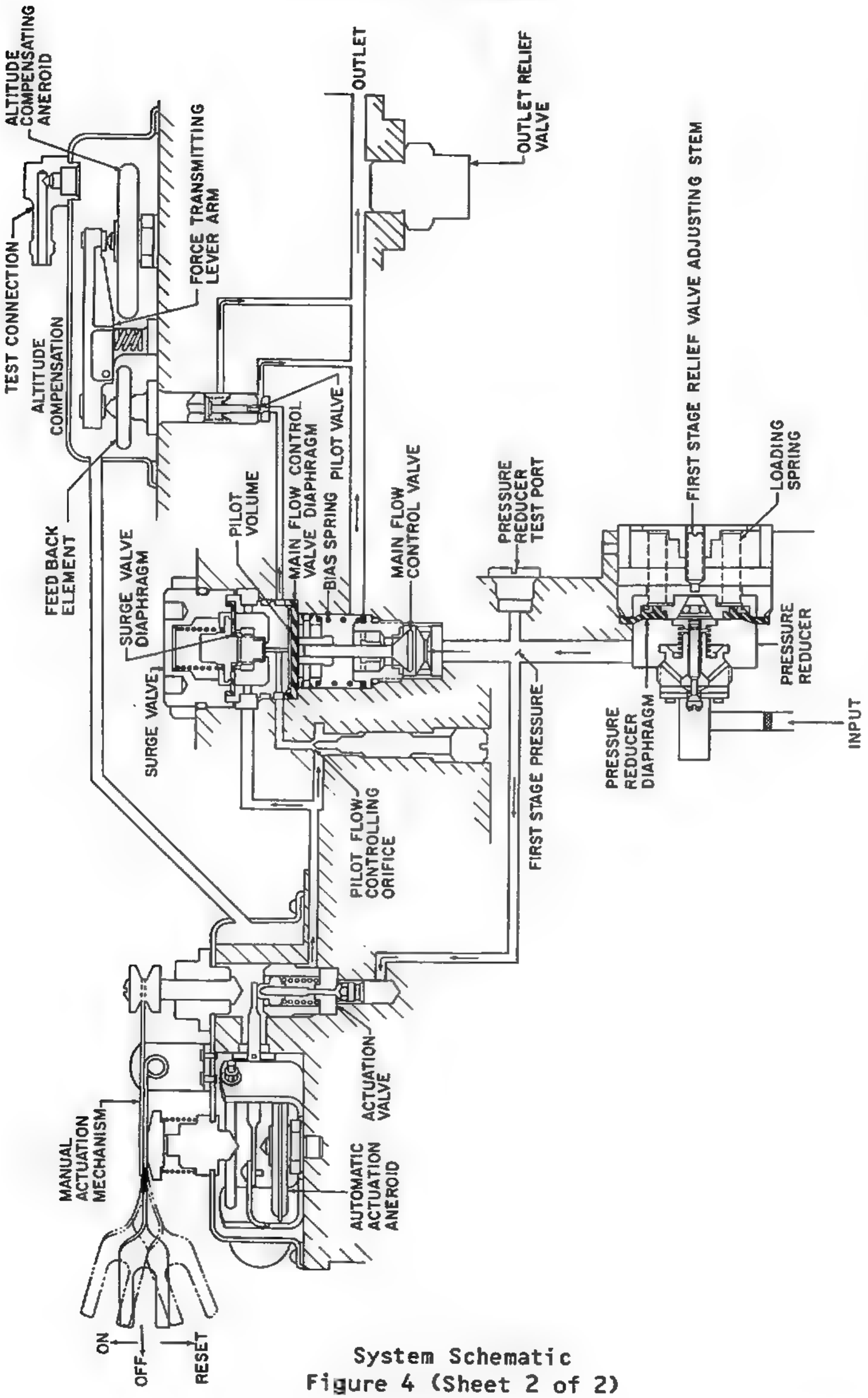
(5) Manual Reset. (Cabin pressure must be below 12,000 feet altitude.) After actuation (automatic, manual, or electrical) the system may be reset by depressing the manual actuation reset mechanism on the pneumatic control unit or the manual reset mechanism on the electro-pneumatic control unit. The automatic actuation, manual actuation, and electrical actuation capabilities are retained after resetting.



System Schematic
Figure 4 (Sheet 1 of 2)

P/N 22504-7,-11

NOTE ⚠1
THE 22504-9 SERIES CONTROL UNIT DOES NOT CONTAIN A PRESSURE TRANSDUCER



System Schematic
Figure 4 (Sheet 2 of 2)

P/N 22505-7,-9

(6) Pressure Surge. When the actuation valve opens, first stage pressure is admitted underneath the surge valve diaphragm. The pressure in the closed volume above the surge valve diaphragm is initially at ambient. At actuation, the sudden large pressure differential opens the surge valve and admits oxygen into the pilot volume above the main flow control valve diaphragm. With the surge valve open, the pressure in the pilot volume is then nearly equal to the first stage pressure. This occurs because the restriction to flow from the pressure reducer to the pilot volume is small compared to the restriction from the pilot volume to the unit outlet via the pilot valve.

This pilot surge pressure acting on the main flow control valve diaphragm opens the main valve fully and allows oxygen to flow into the outlet. This flow is sufficiently large to pressurize the aircraft system (approximately 670 cu. in.) to a pressure of 50 psig in 4 seconds. The outlet pressure builds up to a value slightly less than the first stage pressure.

The pressure in the closed volume above the surge valve diaphragm gradually rises as oxygen flows through the equalizing orifice located in the surge valve diaphragm assembly. After a period of 7 to 15 seconds, when the pressure differential across the surge valve diaphragm is reduced to approximately 10 to 15 psi, a spring closes the surge valve. Now there is a definite restriction to flow from the pressure reducer to the pilot volume. The pilot pressure becomes equal to the outlet pressure and the bias spring closes the main flow control valve.

(7) Pilot Flow. During normal operation, oxygen (approximately 1.3 SLPM) flows from the first stage through the actuation valve, through the pilot flow controlling orifice, through the pilot volume, through the pilot valve and into the outlet. The magnitude of the pilot pressure depends on the relative restriction upstream and downstream of the pilot volume.

The upstream restriction consists of the pilot flow controlling orifice and is fixed. The downstream restriction consists of the pilot valve and is variable.

(8) Pilot Operation. The altitude-compensating aneroid exerts a force, tending to close the pilot valve, which is counteracted by the force of the outlet pressure acting on the feedback capsular element, tending to open the pilot valve. The pilot valve moves in the direction of the unbalanced force. If the unit outlet pressure is higher than is demanded by the feedback element, the pilot valve opening increases, thereby decreasing the pilot pressure which in turn decreases the opening of the main flow control valve and reduces the output flow. If the feedback element demands a higher outlet pressure than is present in the outlet, the pilot valve opening decreases, increasing the restriction to flow, which raises the pilot pressure and increases the output flow.

(9) Altitude Compensation. From ground level to approximately 17,000 feet, the altitude compensating aneroid does not contact the force transmitting lever arm and has no effect on unit performance.

The feedback capsular element is pre-loaded so that a constant outlet pressure of approximately 4 psig is required to keep the pilot valve open. At approximately 17,000 feet the aneroid contacts the lever arm and develops a force, increasing linearly with decreasing ambient pressure, which adds to the preload force of the feedback element, and produces a corresponding increase in the outlet pressure.

(10) Relief Valve (First Stage). The first stage pressure relief valve is integral with the inlet valve actuating shaft and seats on the pressure reducer diaphragm.

When the inlet valve is closed, a further build-up in the first stage pressure due to any leakage will first remove the force of the loading spring on the inlet valve. The load spring force balances the force due to the inlet pressure. During this time there is no movement of the assembly. Then with a further pressure build-up the diaphragm assembly begins to move back against the loading spring carrying the relief valve with it.

When the relief valve contacts the rigid stop, its motion is arrested until the force of the first stage pressure against the relief valve is transferred from the diaphragm to the stop.

When the force of the pressure acting on the smaller annular diaphragm area equals the force of the loading spring, the diaphragm moves away from the relief valve and venting begins.

(11) Relief Valve (Outlet). A high flow capacity outlet pressure relief valve is incorporated to ensure that outlet pressure can never exceed 150 psi.

4. Trouble Shooting

A. Do not attempt to repair either control unit in the field. At the first sign of improper operation, replace the defective control unit and send the replaced control unit to a qualified overhaul depot.

5. Maintenance Practices

A. Servicing

(1) No servicing is required.

B. Removal/Installation

WARNING: SHUT OFF THE OXYGEN SOURCE PRIOR TO DISCONNECTING THE TUBING TO THE INLET AND OUTLET PORTS. USE THE WRENCH FLATS PROVIDED ON THE INLET AND OUTLET CONNECTORS WHEN REMOVING OR INSTALLING TUBING.

(1) The control units are normally mounted by four screws through the back plate mounted to the body of the control units.

NOTE: A remote mechanical control assembly is attached to the manual actuation mechanism and the reset mechanism of the control units at installation.

(2) Disconnect the remote mechanical control assembly; the connections to the inlet and outlet connectors and then remove the mounting screws. Use care to avoid distortion of the connectors. Plug all openings to prevent the entrance of foreign materials.

C. Adjustment/Test

(1) No adjustment or test of the control system is required.

D. Inspection/Check

(1) After installation, the control system may be checked for manual and electrical operation. (Refer to steps (2) and (3) below.)

(2) Apply oxygen pressure to the control system inlet and manually raise the manual actuation mechanism on the pneumatic control unit. The control system shall open, as noted by oxygen flow to the passenger mask compartments and the control system indicators shall indicate "ON". Reset the system as outlined in paragraph 3.C, step (5). (System indicators shall indicate "OFF".)

(3) With the aircraft electrical system energized, and oxygen pressure applied to the control system, open the control system by activating the control system switch in the cockpit of the aircraft. The control system shall open, as noted by oxygen flow to the passenger mask compartments and the control system indicators shall indicate "ON". Reset the system as outlined in paragraph 3.C, step (5). (System indicators shall indicate "OFF".)

(4) With the control system activated, leak test the system by applying leak test solution, conforming to Specification MIL-L-25567, to the inlet and outlet connectors. No leakage shall be evident.

NOTE: After performance of leak test, reset the control unit(s) and bleed system pressure.

(5) If either control unit fails to meet the inspection/check requirements, remove the unit or units and return the unit(s) to a qualified overhaul facility.

6. Cleaning/Painting

(1) Clean the outside of the control units with a dry cloth.

(2) No painting is required.

7. Approved Repairs

(1) Do not attempt to repair a defective control unit in the field. Return the defective control unit or units to a qualified overhaul facility for all repairs.